

CLAIMS:

1. A method for producing a 1-[4-(biphenyl-4-carbonyl)]phenylaminoanthraquinone colorant composition, said method comprising:

reacting a 4-halobenzoic acid with about 1 mole to about 4 moles of a halogenating agent per mole of said 4-halobenzoic acid to form a 4-halobenzoyl halide composition;

reacting in the presence of a first catalyst composition, said 4-halobenzoyl halide composition with biphenyl, in a solvent to form a 1-[4-(biphenyl-4-carbonyl)]halobenzene composition; and

reacting in the presence of a second catalyst composition and an acid scavenger, said 1-[4-(4-phenylbenzoyl)]halobenzene composition with a 1-aminoanthraquinone, in a reaction medium comprising a dipolar aprotic solvent, to form said 1-[4-(biphenyl-4-carbonyl)]phenylaminoanthraquinone colorant composition.

2. The method of Claim 1, wherein said reacting 4-halobenzoic acid with a halogenating agent to form a 4-halobenzoyl halide composition further is conducted in a solvent comprising aromatic compounds having from about 6 to about 9 carbon atoms, and aliphatic and alicyclic compounds having from about 1 to about 6 carbon atoms.

3. The method of Claim 1, wherein said 4-halobenzoic acid is at least one selected from the group consisting of 4-chlorobenzoic acid, 4-bromobenzoic acid, 4-iodobenzoic acid, and mixtures thereof.

4. The method of Claim 1, wherein said halogenating agent comprises a halogen-containing phosphorus compound, a halogen-containing sulfur compound, and a carbonyl halide.

5. The method of Claim 1, wherein said halogenating agent is selected from the group consisting of PCl_3 , PCl_5 , PBr_3 , POCl_3 , POBr_3 , carbonyl chloride, carbonyl bromide, thionyl chloride, thionyl bromide, sulfuryl chloride, and mixtures thereof.

6. The method of Claim 1, wherein said reacting 4-halobenzoic acid with a halogenating agent further is conducted in the presence of from about 0.1 parts to about 5 parts per 100 parts by weight of said 4-halobenzoic acid, of a catalyst comprising an amide compound or a urea compound.

7. The method of Claim 1, wherein said solvent comprises nitroaromatic compounds, nitroaliphatic compounds, and halogen-containing $\text{C}_1 - \text{C}_4$ aliphatic compounds,

8. The method of Claim 1, wherein reacting said 4-halobenzoyl halide composition with biphenyl is carried out at from about an ambient temperature to about 200°C .

9. The method of Claim 1, wherein reacting said 4-halobenzoyl halide composition with biphenyl is carried out at from about 50°C to about 200°C .

10. The method of Claim 1, wherein reacting said 4-halobenzoyl halide composition with biphenyl is carried out for a duration from about 1 hours to about 10 hours.

11. The method of Claim 1, wherein reacting said 4-halobenzoyl halide composition with biphenyl is carried out for a duration from about 2 hours to about 8 hours.

12. The method of Claim 1, wherein said first catalyst composition comprises an inorganic halide having the formula M^1X_m , wherein " M^1 " is at least one element selected from groups 3 to 15 of the Periodic Table; and " m " is an integer having a value from about 2 to about 5.

13. The method of Claim 1, wherein said first catalyst composition comprises at least one of zinc(II) chloride, aluminum(III) chloride, boron(III) fluoride etherate, and iron(III) chloride.

14. The method of Claim 1, wherein said first catalyst composition comprises from about 90 moles to about 100 moles per 100 moles of said 4-halobenzoyl chloride.

15. The method of Claim 1, wherein said dipolar aprotic solvent is selected from the group consisting of N,N-dimethylformamide, N-methyl-3-pyrrolidinone, N,N-dimethylacetamide, dimethylsulfoxide, 1,3-dimethyl-2-imidazolidinone, and sulfolane, and mixtures comprising any of the foregoing solvents.

16. The method of Claim 1, wherein reacting said 1-[4-(4-phenylbenzoyl)]halobenzene composition with said 1-aminoanthraquinone is carried out at a temperature of from about 50°C to about 200°C.

17. The method of Claim 1, wherein reacting said 1-[4-(4-phenylbenzoyl)]halobenzene composition with said 1-aminoanthraquinone is carried out at a temperature of from about 100°C to about 170°C.

18. The method of Claim 1, wherein reacting said 1-[4-(4-phenylbenzoyl)]halobenzene composition with said 1-aminoanthraquinone is carried out for a period from about 12 hours to about 30 hours.

19. The method of Claim 1, wherein reacting said 1-[4-(4-phenylbenzoyl)]halobenzene composition with said 1-aminoanthraquinone is carried out for a period from about 18 hours to about 24 hours.

20. The method of Claim 1, wherein said second catalyst composition comprises of copper, CuX, and CuX₂, wherein "X" is selected from chloride, bromide, iodide, and a mixture thereof.

21. The method of Claim 1, wherein said second catalyst composition comprises copper and CuI.

22. The method of Claim 1, wherein said second catalyst composition comprises about 0.05 parts to about 25 parts per 100 parts by weight of 1-aminoanthraquinone.

23. The method of Claim 1, wherein said acid scavenger comprises alkali metal carbonates, alkaline earth metal carbonates, alkali metal bicarbonates; alkaline earth metal bicarbonates, and alkali metal carboxylates and alkaline earth metal carboxylates having the general formula $M(\text{COOR}^1)_n$, wherein "M" is an alkali metal or an alkaline earth metal, R^1 is a monovalent alkyl group having from about 1 to about 6 carbons, and "n" is selected from 1 and 2.

24. A method for producing a 1-[4-(biphenyl-4-carbonyl)]phenylaminoanthraquinone colorant composition, said method comprising:

reacting one mole of a 4-bromobenzoic acid with about 1.1 moles to about 4 moles of thionyl chloride per mole of 4-bromobenzoic acid to form a 4-bromobenzoyl chloride composition;

reacting in the presence of aluminum chloride, said 4-bromobenzoyl chloride composition with biphenyl in a solvent comprising nitrobenzene, to form a 1-[4-(biphenyl-4-carbonyl)]bromobenzene composition; and

reacting in the presence of an acid scavenger comprising potassium carbonate and sodium acetate, and a second catalyst composition comprising about 1 part of copper per part by weight of copper(I) iodide, said 1-[4-(4-phenylbenzoyl)]bromobenzene composition with a 1-aminoanthraquinone in a solvent comprising N,N-dimethylformamide, to form said 1-[4-(biphenyl-4-carbonyl)]phenylaminoanthraquinone colorant composition.